

**NATURAL RESOURCES CONSERVATION SERVICE  
INTERIM CONSERVATION PRACTICE STANDARD**

**CONSERVATION POWER PLANT**

(No.)

CODE (716)

**DEFINITION**

A facility for producing electrical energy from renewable resources.

**PURPOSE**

Provide an alternate and dependable source of power that is not generated by fossil fuels, for farm and ranch operations

**CONDITIONS WHERE PRACTICE APPLIES**

Wherever agriculture power needs can be met or supplemented by use of alternative power sources.

This standard only applies to the use of wind, solar and hydro power plant alternatives.

For power plants designed to produce 500 kilowatts (kW) or less.

**CRITERIA**

**General Criteria Applicable to All Waste Treatment Purposes**

The efficiency of the power units, type of power utilized, quantity of power produced, quality of buildings or structures, automation features and other accessories installed shall be in keeping with the economic and environmental value of the system to accomplish the conservation objectives.

Prior to the installation of any system that is planned as a grid-connected system, written approval will be secured from the receiving local utility.

All systems shall provide appropriate backup systems based on the risk associated with the inoperability of the planned power plant facility.

**Electrical Systems**

All electrical systems shall be installed to meet the 2005 NEC or local electrical code, whichever is more restrictive. A licensed electrician shall certify all installations.

All components shall be warranted against material and workmanship defects for a period of no less than one year from installation.

**Design**

The system provider shall complete and supply to the land owner/operator a detailed design of the facility clearly outlining the objectives and anticipated outcomes of implementation.

Independent, verifiable data demonstrating results of the use of the facility or process in other similar situations and locations shall be provided.

**Power Plants**

Power plants shall be selected on the basis of availability of the power resource, operating conditions, critical nature of need, and conservation needs and objectives, including the need for automation.

The system shall be designed to provide no more than 150 percent of the annual peak daily on-farm usage.

All components shall be warranted against material and workmanship defects for a period of no less than one year from installation.

**Building and accessories**

The design of the power plant and associated housing, if required, shall consider accessibility for equipment, maintenance and repairs, and the need for protecting equipment from the elements, vandalism, fire and flood.

Power units shall be mounted and installed according to the manufacturer's recommendations.

All structural features and equipment shall provide adequate safety features to protect workers and the public from injury.

### **Wind Turbine System**

All acceptable wind turbine power plants shall include the following components:

- Wind turbine which includes blades, rotor, generator and over speed control mechanism.
- Tower
- Electrical control system
- Backup power

A wind turbine manufacturer, dealer or installer will size the system based on the electricity needs and specific local wind patterns. An economic analysis will be calculated to predict cost and fossil fuel savings. A list of manufacturers is available from AWEA (American Wind Energy Association). The installation must follow the manufacture's recommendations identified in the Owners Manual. The installer will have the installation inspected and certified by a licensed electrician.

A minimum wind power Class of 3 is required based on the U.S. Dept. of Energy, National Renewable Energy Laboratory's 50 Meter Wind Class Map for Colorado unless wind power can be verified to be of Class 3 quality with anemometer data or by an equally objective and verifiable source. All wind turbines are required to have automatic over speed-governing systems.

### **Tower.**

All towers (structures to which turbines will be mounted) need to be of sufficient height that the sweep of the blades is a minimum of 30 feet above and 100 feet away from any obstacle. Guy wires are to be installed per the manufacture's recommendations. All construction drawings for the installation of the towers must be certified by a State of Colorado licensed professional structural engineer. All lighting shall meet the minimum requirements of Federal Aviation Administration regulations.

### **Photovoltaic (PV) Power System**

An acceptable PV power plant shall include the following components:

- Photovoltaic array and mounting structure.
- Electrical control system.
- Backup power
- Protective structures.

### **Solar Insolation Data**

Site specific data, (energy received per unit area per day), are preferable for system design. Where site specific data is not available, solar insolation values may be estimated using data from National Renewable Energy Laboratory, Department of Energy, Technical Paper 463-5607.

The daily electrical demand will be used as a guide for determining the size of the PV array.

### **PV System Components.**

PV modules must have as a minimum, a manufacturer's warranty against power degradation in excess of 10% of the rated power for no less than ten years after installation. PV modules shall be listed by Underwriters Laboratories (UL) or another nationally recognized testing laboratory.

### **Hydropower System**

All hydropower plants shall include the following components:

- Intake control gates with screens to
- Prevent the entry of fish, plants, animals and debris.
- Penstock and flow by-pass system
- Turbine and generator
- Electrical control system
- Tailrace

A hydropower turbine manufacturer, dealer or installer will size the system based on the electricity needs and specific flow conditions at the site.

The equipment shall be designed and installed in accordance with standard engineering practice and the manufacturer's recommendations identified in the Owners Manual. The installer will have the installation inspected and certified by a licensed electrician.

The impacts of the hydropower facility on aquatic habitats and species shall be assessed. Potential adverse effects on federal and state threatened or endangered species, federal

candidate or proposed species, and state species of special concern shall be mitigated as appropriate, for example, by incorporating screens and fish passage structures into the hydropower plant design.

## **CONSIDERATIONS**

### **Wind Turbine System**

When planning this practice the following items should be considered, as applicable:

- Can the system be protected from natural events such as fire, flood or hail?
- What is the service life of the system and cost recovery?
- Does the manufacturer, dealer or installer have O&M support staff available?
- Aesthetic concerns.
- Is the ambient noise level of the system going to be a concern?
- Migratory fly ways, what is the probable danger to birds, bats, and pollinators.

### **PV System**

When planning this practice the following items should be considered, as applicable:

- Can the system be protected from natural events such as fire, flood or hail?
- What is the service life of the system and cost recovery?
- Does the manufacturer have O&M support staff available?
- Aesthetic concerns.
- Solar trackers, as a component of a PV power system, to provide for greater efficiency of collection.
- In lightning prone areas consideration should be given to locating the system away from high points in the topography, installing lightning rods adjacent to the system, and including lightning surge protection in the system specifications.

### **Hydropower System**

Water rights and permit issues should be considered when planning hydro power systems.

## **PLANS AND SPECIFICATIONS**

Plans and specifications for constructing power plants shall be in compliance with this standard and describe the requirements for properly installing the practice to achieve its intended purpose.

A site plan and site specific construction specifications shall be prepared for each system.

## **OPERATION AND MAINTENANCE**

An Operation and Maintenance plan specific to the facilities installed shall be prepared for use by the landowner or responsible operator. The plan shall provide specific instruction for operating and maintaining facilities to ensure the power plant functions properly. All component manufacturers' instructions appropriate for the specific equipment installed at the site shall be attached to the plan upon completion of the job. The plan shall include the provision to address the following, as a minimum:

- Inspection and testing of all power plant components and appurtenances.
- Proper start-up procedures for the operation of the power plant.
- Routine maintenance of all mechanical components.
- Periodic removal of fire hazard material from around the site.
- Routinely test and inspect all automation components of the power plant to assure they are functioning as designed.
- Periodic inspection of all safety features to ensure they are in place and functional
- For PV power plants adjust the tilt angle of the solar modules on a seasonal basis, if applicable.
- Provide emergency shut down procedures.

## REFERENCE

U.S. Army Corps of Engineers, Nation Wide Permit Information, Permit 17 Hydropower Projects

U.S. Dept of Energy, Energy Efficiency and Renewable Energy, Wind & Hydropower Technologies Program. State Wind Resource Map.

U.S. Dept of Energy, Energy Efficiency and Renewable Energy, Wind & Hydropower Technologies Program. State Resource Assessment Reports.

U.S. Dept of Energy, Energy Efficiency and Renewable Energy, Solar Energy Technologies Program. Photovoltaics

U.S. Fish and Wildlife Service. 2003. INTERIM GUIDELINES TO AVOID AND MINIMIZE WILDLIFE IMPACTS FROM WIND TURBINES. <http://www.fws.gov/habitatconservation/wind.pdf>

U.S. Dept of Energy, Energy Efficiency and Renewable Energy, Wind & Hydropower Technologies Program. Colorado Wind Resource Map.

U.S. Dept of Energy, Energy Efficiency and Renewable Energy, Small Wind Electric Systems, A Colorado Consumer's Guide.

National Wind Coordinating Collaborative  
<http://www.nationalwind.org/default.htm>

National Renewable Energy Laboratory. Solar Radiation Data Manual for Flat-Plate and Concentrating Collectors. National Renewable Energy Laboratory, Golden, CO, April, 1994

Naval Facilities Engineering Command. Maintenance & Operation of Stand-Alone Photovoltaic Systems. Revised 1991. Photovoltaic Design Assistance Center, Sandia National Laboratories, Albuquerque, NM, March 1993

Southwest Technology Development Institute. Photovoltaic Power Systems and the Nation Electrical Code: Suggested Practices. Review Draft, Sandia National Laboratories, Albuquerque, NM, August 1994.

Stevens, John W., et al.. Photovoltaic Power As A utility Service: Guidelines For Livestock Water Pumping. Photovoltaic Design Assistance Center, Sandia National Laboratories, Albuquerque, NM, March 1993.